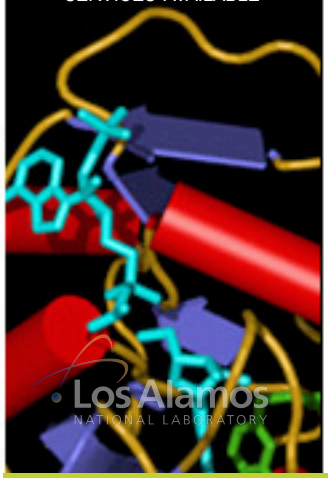
AOT & LANSCE The Pulse

April 2011

INSIDE



Record isotope production supports U.S. cardiac care

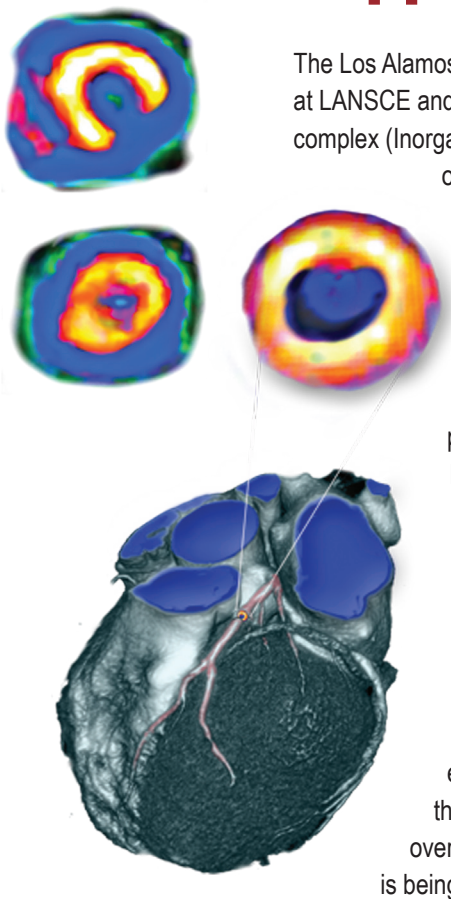


Image of a heart during a normal rest-stress myocardial perfusion PET study. Isotopes produced at IPF are critical for medical diagnosis and disease treatment. These positron emission tomography images were made possible using Sr-82. Production of this critical isotope impacts approximately 23,000 domestic cardiac patients every month.

The Los Alamos Isotope Program, through the Isotope Production Facility (IPF) at LANSCE and the hot cell processing facilities at the TA-48 radiochemistry complex (Inorganic, Isotope and Actinide Chemistry, C-IIAC), has a long history of supplying medical radioisotopes to the U.S. healthcare industry for cardiac imaging and the calibration of medical devices that are critical to domestic healthcare.

In recent years, the Isotope Program has been called upon to produce additional large amounts of the cardiac imaging isotope strontium-82 (Sr-82) used for cardiac imaging via positron emission tomography (PET) at hospitals nationwide. Demand for this particular isotope is increasing owing to the current shortage of molybdenum (Mo-99) used in single photon emission tomography (SPET) cardiac scans.

In mid-2009, the Laboratory generated what was then a record for production of Sr-82, shipped from LANL in the LANSCE FY 2009 run cycle. Production in FY 2010 increased by approximately 10% for Sr-82 product shipped from LANL, establishing an overall 350% production growth since 2005. In the current FY 2011 run cycle, production of Sr-82 is occurring at over two times the rate of the 2010 production cycle. This increase is being achieved in part by operating IPF in dedicated mode for the month of January, in response to DOE's Office of Science, Nuclear Physics request that LANSCE and IPF postpone their scheduled shutdown and dedicate an additional 25 days of operation to produce the critical isotope. The radiochemistry team processed the material in the hot cells facility at TA-48, RC-1, and then sent the Sr-82 to customers for distribution.

IPF is one of only five production facilities worldwide capable of supplying the Sr-82 demand. Facilities such as the IPF, Brookhaven National Laboratory in New York, Institute of Nuclear Research in Russia, and iThemba in South Africa coordinate their production run cycles to optimize the Sr-82 supply. However, medical needs, the short half-life (25 days), and the ongoing Mo-99 shortage threaten a crisis in Sr-82 supply. Finding creative ways to produce additional Sr-82 could help defer this crisis. In principle, IPF could operate at higher beam currents to generate more Sr-82, but present target materials cannot reliably

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From Alex's Desk

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Colleagues,

After many, many months we have received the final approvals from the Department of Energy designating LANSCE's Proton Radiography (pRad) Facility, the Lujan Neutron Scattering Center, and the Weapons Nuclear Research (WNR) center as DOE User Facilities. This is a very high level agreement between NNSA and DOE-Office of Science. Even though this might sound trivial (and it should be) and it is how the facilities have been operating for a long time, due to odd circumstances we had lost our DOE User Facility designation. The good news is... all resolved and we are back on track. To complement this, LANSCE facilities received a record number of proposals for this first FY11 call. We are also continuing to accommodate additional proposals, using the fast access process. In particular, we trying our best to accommodate additional proposals from our J-PARC (Japan Proton Accelerator Research Complex) colleagues.

Additional good news: the target in Target-4 (WNR) has been finally removed and will be able to be replaced in time for the upcoming run cycle. It was a tough process and thanks to the dedication and hard work of all involved in the issue it got resolved.

'LANSCE facilities received a record number of proposals for this first FY11 call.'

At the beginning of this month I had the honor to represent LANSCE on a NUFO (National User Facility Organization) poster session on Capitol Hill. Steven Conradson (MST-8, current LUG chair) joined me. This was a great opportunity to showcase our science and our user outreach. A replica of the poster Steven and I presented is right by my office. Stop by and take a look and see how broad LANSCE science is.

LANSCE Deputy Division Leader Alex Lacerda

Celebrating service

Congratulations to the following Anna Llobet, LANSCE-LC, celebrating her 10-year service anniversary this month.

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Isotope . . . withstand higher beam currents. Isotope Program staff are developing new methods for target analysis and are engaging LANL experts in materials science and engineering to develop new production targets suitable for higher beam currents.

In addition to producing the present portfolio of isotopes, IPF enables research in the production of new isotopes, including actinium-225 (Ac-225), which provides unique and revolutionary cancer treatment opportunities. Ensuring a stable supply of these isotopes for medical research and clinical trials, while at the same time supplying record-breaking amounts of Sr-82, requires unprecedented run-time reliability of both the LANSCE accelerator and the IPF facility, close coordination with upcoming LANSCE risk mitigation activities, and improved methods and apparatus for processing at LANL hot cell facilities.

Kevin John is the LANL Program Manager, and Wolfgang Runde is the National Isotopes Program Manager. This work supports the Laboratory's Materials for the Future and the Science of Signatures capabilities.

Technical contacts: Meiring Nortier, Eva Birnbaum, and Kevin John

LANSCE former student selected to attend 61st Lindau Nobel Laureates Meeting in Germany

Mike Jablin (Lujan Neutron Scattering Center, LANSCE-LC) has been selected as a participant of the 61st Lindau Nobel Laureate Meeting in Germany.

The meeting, which is dedicated to physiology and medicine, takes place June 25 -July 2 in Lindau, Germany. Attendance is highly competitive, with 500 attendees accepted from more than 20,000 applicants. The annual meetings provide a forum for the transfer of knowledge between Nobel Laureates and young researchers. Lectures of the Nobel Laureates reflect current scientific topics, future research areas, and address basic research and application-orientated themes. In panel discussions, seminars, and social events, young researchers from more than 60 countries interact with the Nobel Laureates. The researchers are nominated by a global network of Academic Partners, and then carefully evaluated by a review panel.

Also attending will be Dominique Price (Physical Chemistry and Applied Spectroscopy, CPCS).

Jablin is a former undergraduate student of LANSCE-LC scientist Jarek Majewski. They investigated model biomembranes. Jablin gave an invited talk describing their work on the structure and composition of lipid domains in cell biomembranes at the International Student Workshop on Lipid Domains, held at the Weizmann Institute of Science in Israel. He is examining the influence of beta-cyclodextrin on the structure, composition, and reorganization of model membranes composed of mixed sphingomyelin/cholesterol bilayers. During the Laboratory's student symposium, Jablin presented neutron scattering studies of radiationresistant materials. He is a graduate student at Carnegie Mellon University and continues to collaborate with Majewski and other LANL researchers on the physics of biomembranes, including a first-author article in *Physical Review Letters* in March 2011.

Contact: Jaroslaw Majewski

Experiments at the Nuclear Science Lead Slowing-Down Spectrometer

In the last days of LANSCE's 2010 run cycle, Laboratory researchers in collaboration with scientists from Rennselaer Polytechnic Institute and the Commissariat à l'Energie Atomique successfully performed three experiments using the Lead Slowing-Down Spectrometer (LSDS), a 20-ton lead cube with a tungsten neutron spallation target at the center. Because the absorption cross section for lead is low, the neutrons produced by the spallation target traverse the sample many times, resulting in an effective increase in neutron flux of up to three orders of magnitude compared with an experiment performed in the usual time-of-flight geometry. These complex and costly experiments require sole use operation of the LANSCE neutron sources. Therefore, other experiments at the Lujan Center and Target 4 are not possible in this operating mode. The efforts of the LANSCE Accelerator Operations groups and the Radiation Protection group enabled the work. The individual LSDS experiments are described in the following paragraphs.

The DOE Office of Nuclear Energy sponsored an experiment to demonstrate that the isotopic content of plutonium (Pu) and uranium (U) in spent fuel rods could be determined by observing the shape of the neutron spectrum following fission in the LSDS. Since previous attempts to measure fast neutrons from fission were not successful, the scientists made improvements to the neutron detector and signal processing electronics. This enabled sufficient measurements to evaluate the technique. The figure shows the measured yield as a function of time for ^{235}U compared to a simulation. Principal participants are Matt Devlin, John O'Donnell, and Robert Haight (Neutron and Nuclear Science, LANSCE-NS);

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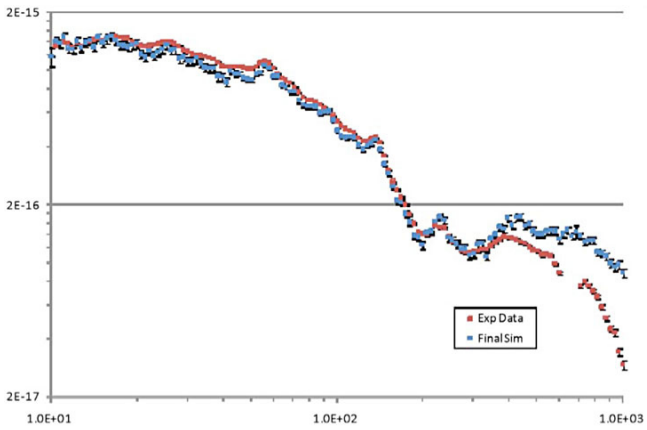
Experiments . . . and Victor Gavron (LANSCE-DO). The work supports the LANL Energy Security mission area and the Materials for the Future capability pillar.

The NNSA Stockpile Stewardship Academic Alliance sponsored an experiment to determine the cross section of neutron-induced reactions that produce alpha particles. Because alpha particles produce much smaller signals than fission products, these measurements are challenging and require significant technical development. Scientists used a diamond detector to measure reactions on vanadium-50 and samarium-147. The research is part of the PhD thesis of Jason Thompson (Rensselaer Polytechnic Institute, New York), who is performing his thesis research under the supervision of Yaron Danon (Rensselaer Polytechnic Institute). These reactions are important for understanding both radiochemical (RadChem) weapons diagnostics as part of the Stockpile Academic Alliance program, and for studying the neutron environment in stars. Robert Haight (LANSCE-NS) participated in the research, which supports the Lab's Nuclear Deterrence mission area.

NNSA sponsored measurements of the ^{237}U fission cross-section to address an important issue of LANL's RadChem diagnostic program. This was a challenging measurement due to the short half-life (approximately 6.7 day) and high activity (approximately 0.5 Ci) of the sample. Oak Ridge National Laboratory prepared the sample by irradiation of ^{236}U in the High Flux Isotope Reactor (HFIR). After chemical purification of the sample, it was assembled into a shielded gas ionization chamber and shipped to LANL for the measurements. This was a time-critical shipment because of the scheduled beam time and the loss of material from radioactive decay. Principal participants are Marian Jandel, Todd Bredeweg, Evelyn Bond and David Vieira (Nuclear and Radiochemistry, C-NR); John O'Donnell, Leo Bitteker, Steve Wender and Robert Haight (LANSCE-NS); Chuck Alexander and Mitch Ferren (Oak Ridge National Laboratory). The work supports the Lab's Nuclear Deterrence mission area.

Dmitri Rochman and the Lead Slowing-Down Spectrometer (LSDS).



Measured yield for ^{235}U (in red) compared to simulations (in blue). The simulations include surrounding material including walls, floor, aluminum stand, etc.

Neutron scattering examines dynamic properties of biomembranes

Lipid membranes play a critical role in all living systems, including humans. They define the outer boundary of cells, host transmembrane proteins, mediate transport, facilitate intercellular communication, and respond to changes in the surrounding environment. Because they participate in a multitude of tasks, lipid membranes are necessarily complex. Various experimental techniques have been used for the physical and chemical characterization of biomembranes. The sensitivity of neutrons to the light elements, carbon and hydrogen, makes neutron scattering one of best methods to study biomembranes.

In research accepted for publication in *Physical Review Letters*, scientists from the Lujan Neutron Scattering Center at LANSCE and collaborators from Ruhr-University and University of South Florida made the first successful demonstration that the Distorted Wave Born Approximation (DWBA) can be used to understand both the static and the dynamic structures of the model biomembranes. The researchers employed the Surface Profile Analysis Reflectometer (SPEAR) at the Lujan Neutron Scattering Center for the measurements. SPEAR is a time-of-flight neutron reflectometer that measures chemical density profiles of thin layers (5-3000 Å) in a variety of different environments. The instrument uses an unpolarized neutron beam to study solid/solid, solid/liquid, solid/gas, and liquid/gas interfaces. The scientists analyzed off-specular neutron scattering (see figure) with distorted wave-Born approximation from a thermoresponsive polymer-supported single 1,2-dipalmitoyl-sn-glycero-3-phosphocholine (DPPC) lipid bilayer in a liquid environment. Only the distorted wave-Born approximation accurately models scattering near the total reflection

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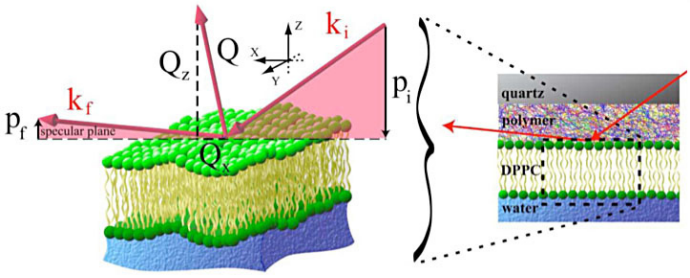
Neutron . . . region. The researchers measured interfacial fluctuations of the system and compared the data with theoretical calculations. Analysis of off-specular scattering can provide insight into a wide range of in-plane phenomena in situ to understand complex behavior of cellular membranes, protein transport and docking, lipid segregation into ordered domains, and modification of bulk membrane elastic properties due to membrane constituents and external stimuli. The researchers concluded that this model polymer-membrane system successfully mimics the complexity of cellular membrane morphology and offers opportunities to investigate how membrane composition and various external biological agents (toxins, viruses, and other pathogens), affect in- and out-of-plane membrane structure.

Reference: "In-Plane Correlations in a Polymer-Supported Lipid Membrane Measured by Off-Specular Neutron Scattering," *Physical Review Letters* (in press). Researchers include Michael Jablin, Mikhail Zhernenkov, Manish Dubey, Hillary Smith, Alan Hurd, and Jaroslaw Majewski (LANSCE-LC), B. Toperverg and A. Vidyasagar (Ruhr-University, Germany), and R. Toomey (University of South Florida). The DOE Office of Basic Energy Sciences funded the Los Alamos researchers and the Lujan Center.

Technical contact: Jaroslaw Majewski

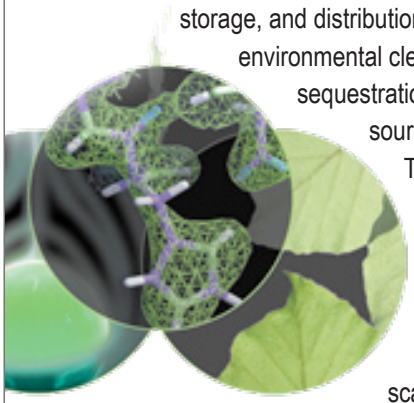


Geometry for an off-specular scattering event. The neutrons penetrate through the quartz substrate and polymer cushion to reach the buried membrane (shown on right). If the incident and outgoing angles are unequal, then the momentum transfer vector, Q (the difference of the reflected, kf, and incident, ki, wavevectors), has components perpendicular, Qz, and parallel, Qx, to the scattering interface. Qx probes in-plane structure.

Neutron School will focus on energy and the environment

The Los Alamos Neutron Science Center (LANSCE) will hold its 2011 Neutron School on July 12 – 22 at in Los Alamos. The DOE, National Science Foundation, LANSCE, and New Mexico State University jointly sponsor the school. The annual school focuses on specific science topics to which neutron scattering makes a critical impact. This focus makes it distinct from other national neutron schools.

This year's theme focuses on the study of materials for energy and environment research. Novel approaches to energy production, storage, and distribution, pollution prevention, environmental cleanup and protection, carbon sequestration, and raw materials sources are urgently needed.



The development of new functional materials and a better understanding of natural materials and processes will play a central role in this endeavor. Neutron scattering, in all its diversity, will contribute significantly to the arsenal of sophisticated materials characterization techniques for energy and environmental research.

The goal of the neutron school is to introduce a variety of neutron scattering techniques to the students and demonstrate how they complement other analytical methods to elucidate material structure and properties. In addition to introductory lectures on neutron scattering, experts will present contemporary research on materials science aspects of energy and environmental research.

Afternoons will be devoted to hands-on neutron scattering experiments (small-angle scattering, reflectometry, powder diffraction, pair distribution function analysis, neutron vibrational spectroscopy, radiography) and data analysis. A variety of materials related to energy and environmental issues will be selected for these exercises.

James Rhyne (LANSCE-LC) is the school director, and local organizing committee members include Luke Daemen and Monika Hartl (LANSCE-LC), John Gordon (Inorganic, Isotope and Actinide Chemistry, CIIAC), and Donald Hickmott (Earth and Environmental Sciences, EES-DO). Laboratory presenters include keynote speaker Kevin Ott (Applied Energy, SPO-AE); banquet speaker Greg Kubas (CIIAC); and lecturers David L. Clark (Institutes, INST-OFF), S. Zoe Fisher (Bioenergy and Environmental Science, B-8), Victor Klimov (Physical Chemistry and Applied Spectroscopy, C-PCS), and Andrew Sutton (C-IIAC). Leads for the hands-on experiments include Katharine Page, Sven Vogel, Michel Mocko, Jarek Majewski, Rex Hjelm, and Luke Daemen (LANSCE-LC).

Potential students should apply before April 15. The school is open to graduate students and postdoctoral researchers only, and the number of participants is limited to 30. They will be selected based on a statement of interest and two letters of recommendation. Travel, hotel, and meals will be covered. For details about the school, please see http://lansce.lanl.gov/neutronschool/).

Technical contacts: Luke Daemen or Monika Hartl

HeadsUP!

Teaming up to provide solutions

Want to help your co-workers find answers to safety and security issues that leave them frustrated and unable to get their work done efficiently? Consider volunteering to serve on one of the LANSCE Solutions Teams.

Begun this year, the three-member teams, composed of an R&D staff member, one Worker Safety and Security Team (WSST) member and a technician or research technologist, perform peer-to-peer walkarounds of work areas with the intent of finding and fixing vulnerabilities on the spot. In ADEPS, WSST members participate in a similar exercise as part of the Management Observation and Verification process.

"You're doing your coworkers a favor by pointing out potentially hazardous situations, helping them get the resources they need, and documenting trends you're not even aware of," said Eve Bauer of the Materials Chemistry (MPA-MC) Solutions Team and chair of the Materials Physics and Applications WSST.

Housekeeping, waste reduction, and electrical issues are some of the more common challenges taken up by the teams, Bauer said. "In one of our walkarounds we noticed an exposed wire in an 110 outlet and we were able to get that fixed right away. It didn't get lost in the system," she said. The electrical safety officer was called in to check the space and offered safe alternatives to the "daisy chaining" (plugging into each other) extension cords.

Teams are required to document their findings and present an informational summary at the end of their term to the ADEPS Council that captures the overall evaluation of the safety culture and identifies problem areas and deficiencies. Team members serve for about three months and participation generally requires about an hour and half of a person's time. "You can get as involved as you want," Bauer said.

"Solutions Teams look out for our colleagues by helping them get the resources they need to do their work in a safe and secure manner."
Associate Director Experimental Sciences Susan J. Seestrom

To volunteer for a Solutions Team, to schedule a walkaround, or for more information, contact one of your group's WSST members.

Your TA-53 WSST members

WSST Chair: Eric Larson
WSST Co-chair: Kristy Ortega
WSST Secretary: Jean Trujillo
E-mail: wsst53@lanl.gov

LANSCE-LC: Eric Larson (primary), Mel Borrego
LANSCE-NS: Steve Wender (primary), Leo Bitteker
LANSCE-DO: Howard Nekimken, Kurt Schoenberg (champion)
AOT-ABS: Nathan Okamoto (primary), Hank Alvestad
AOT-IC: Phil Chacon (primary), Fermin Gonzales
AOT-MDE: Dominic Tafoya (primary), Victor Vigil
AOT-DO: John Erickson
AOT-OPS: Vince Melito (primary), Thomas Spickermann
AOT-RFE: William Roybal
P-23: Peter Pazuchanics
P-25: Jeff Bacon (primary), Jack Johnson, Jason Medina
LFO-DO: Dan Seely (champion), Kristy Ortega
LFO: Carl Morgan, Gail Onyegbula (security officer), John Graham (ESHQ, BSH Advisor)
ISR-6: Taylor Martinez (primary, co-chair), Ellen Guenette

Meeting planning services available

Got a conference that needs organizing, an event to be planned? Rose Romero, the ADEPS meeting coordinator, can help.

With 15 years of Los Alamos conference planning experience, Romero has assisted staff members in planning conferences both large and small, from locally held meetings with a dozen participants to international conferences for hundreds of attendees. Knowledgeable in the Laboratory's conference management policies and associated allowable conference costs, she can help in overseeing the details that ensure a smooth, successful event.

Romero can assist with developing and overseeing allocated workshop budgets, obtaining the necessary cost codes for workshop funding, negotiating and overseeing contracted food services, and in planning and executing workshop and conference web sites. Her experience includes arranging for transportation, conference facilities, and accommodation and preparing pre-conference materials such as invitation letters, badges, folders, and participant lists. During the workshop, she can manage the registration desk, help in setting up meeting rooms, and in compiling agenda, abstracts, and related materials into post-conference documents.

"I love the variety and working on things from start to finish," Romero said. "Meeting planning is like putting together a puzzle. Every piece must fit the puzzle for the puzzle to be successfully complete."

Romero can be reached by calling 665-7657or e-mailing rbromero@lanl.gov.